

## NATURAL RESOURCES CONSERVATION SERVICE

### CONSERVATION PRACTICE STANDARD

#### Waste Treatment Lagoon

(Number)

Code 359

#### DEFINITION

A waste treatment impoundment made by constructing an embankment and/or excavating a pit or dugout.

#### PURPOSES

To biologically treat waste, such as manure and wastewater, and thereby reduce pollution potential by serving as a treatment component of a waste management system

#### CONDITIONS WHERE PRACTICE APPLIES

- Where the lagoon is a component of a planned agricultural waste management system.
- Where treatment is needed for organic wastes generated by agricultural production or processing.
- On any site where the lagoon can be constructed, operated, and maintained without polluting air and water resources.
- To lagoons utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage to farm buildings, agricultural land, or township and country roads.

- This standard does not apply to Waste Storage Structures (313).

Does not apply to human waste storage.

#### CRITERIA

##### General Criteria for All Lagoons

**Laws and Regulations.** Waste treatment lagoons must be planned, designed, and constructed to meet all federal, state, and local laws and regulations.

**Location.** Waste treatment lagoons shall not be constructed in the 100-year floodway unless permitted by the Indiana Department of Natural Resources, Division of Water.

Access to all manure management systems shall be constructed two feet above the 100-year flood elevation.

Waste treatment lagoons shall not be located in karst terrain or over mines without a detailed geologic exploration and specific design considerations for these sites. Minimum setback distances from other physical features are given in Table 1.

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**Table 1 – Setback Distances**

<b>Features</b> (known and identifiable at the time of application)	<b>Setback Distance</b> (feet)
Public Water Supply and Surface Intake Structure	1000
Surface Waters of the State and Drainage Inlets (including Water and Sediment Control Basins)	300
Sinkholes (measured from the superficial opening or lowest point)	300
Water Wells (offsite)	300
Water Wells (onsite)	100
Property Lines and Public Roads	100

**Soil and foundation.** A geologic exploration shall be conducted for all waste treatment lagoons. The exploration must be intensive enough to adequately characterize the site. A minimum of two holes shall be explored. Additional holes may be necessary based on the site size and complexity. The exploration shall extend below the lowest planned elevation of the facility. It shall extend ten feet below for soils in karst topography and five feet below for all others unless sound bedrock is encountered and a professional determination made that the depth is adequate. The exploration shall document the presence or absence of a seasonal high water table. A soils log identifying the soils using the Unified Soil Classification System and showing the location of the seasonal high water table shall be shown on the plans. Soil sampling shall follow guidance in National Engineering Manual IN531-2.

The soil or foundation shall have a maximum specific discharge of  $1/16 \text{ in}^3/\text{in}^2/\text{day}$  ( $1.8 \times 10^{-6} \text{ cm}^3/\text{cm}^2/\text{sec}$ ) or the lagoon shall be lined.

If soils testing shows that *in situ* soils meet the maximum specific discharge criteria, the existing soils shall be over-excavated a minimum of six inches and recompact to break up the existing macropore structure. If a clay liner is used, it shall have a maximum specific discharge of  $1/16 \text{ in}^3/\text{in}^2/\text{day}$  ( $1.8 \times 10^{-6} \text{ cm}^3/\text{cm}^2/\text{sec}$ ). Clay liners shall be a minimum of one foot thick. Bentonite, soil dispersant salts, and impermeable

membranes shall be designed and installed in accordance with Pond Sealing (521A-C).

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The lagoon shall have a bottom elevation that is a minimum of 2 feet above the seasonal high water table or provisions shall be made to lower the water table below the facility. When drainage is planned to lower the water table, care must be taken to ensure that the drains are protected against waste entering the drainage system.

**Waste loading.** Daily waste loading shall be based on the maximum daily loading considering all waste sources that will be treated by the lagoon. Reliable local information or laboratory test data shall be used if available. If local information is not available, Chapter 4 of the Agricultural Waste Management Field Handbook (AWMFH) shall be used for estimating waste loading.

**Treatment period.** The treatment period is the maximum length of time anticipated between periods of drawdown. It shall be the greater of either 60 days or the time required to provide the storage that allows environmentally safe utilization of waste considering the climate, crops, soil, and equipment requirements.

**Required volume.** The lagoon shall have the capability of storing the following volumes. See the Agricultural Waste Management Field Handbook (AWMFH) for guidance in computing volumes.

- Solids accumulation for the period between sludge removal.
- Minimum treatment volume (anaerobic lagoons only).
- Manure, bedding, wastewater, and other wastes accumulated during the treatment period. See by different animal species.
- Normal precipitation less evaporation on the lagoon surface during the storage period.
- Normal runoff from the facility's drainage area during the storage period.

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- f. An additional two feet of freeboard over the above totals.
- g. An additional two feet of freeboard over the totals.

A minimum of 5 years of sludge storage shall be designed into the lagoon. Longer periods of 10 years or more shall be seriously considered if space for lagoon construction is available.

**Embankments.** The embankment shall be constructed of compacted earthfill. If a liner is not used, a cutoff of impermeable soil shall be provided at or just upstream of the embankment centerline. The cutoff shall be deep enough to intercept shallow, pervious foundation strata, have a minimum bottom width of 8 feet, and have side slopes not steeper than 1.5:1. The minimum depth of the cutoff shall be 2 feet after stripping.

The height of the embankment shall be increased by the amount needed to ensure that the design top elevation will be maintained after settlement. This increase shall be not less than 5 percent. The minimum top widths are shown in Table 2. The side slopes of the settled embankment shall not be steeper than 2.5 horizontal to 1 vertical.

**Table 2 – Minimum Top Widths**

<b>Total Embankment Height, ft.</b>	<b>Top Width, ft.</b>
15 or less	8
15-20	10
20-25	12
25-30	14
30-35	15

**Excavations.** Excavated side slopes shall be no steeper than 2.5 horizontal to 1 vertical.

**Inlet.** Inlets shall be of any permanent type designed to resist corrosion, ultraviolet light deterioration, plugging, and freeze damage while incorporating erosion protection as necessary. Inlets from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings or other confined spaces. Inlet pipes shall meet the requirements of Manure Transfer (634).

**Outlet.** The waste treatment lagoon shall have no outlets that can automatically release effluent from the storage portion of the lagoon, except an outlet that releases effluent into another lagoon stage or storage pond. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging. Outlet pipes shall meet the requirements of Manure Transfer (634). Anti-seep collars shall be provided around all pipes.

Emergency spillways shall be provided for lagoons where the contributing drainage area to the lagoon exceeds 50% of the surface area of the lagoon. The emergency spillway flows shall be directed to a secondary containment area, infiltration area, or other appropriate manure storage structure. The spillway shall be located to maximize the distance to the nearest watercourse. The emergency spillway shall be designed for the 50-year, 24-hour storm event and the crest elevation shall be above the freeboard elevation. The top of the berm shall be a minimum of 1 foot above the crest of the emergency spillway.

**Operating levels.** The maximum operating level shall be that level which is the top of dam (or emergency spillway) elevation minus the 2-foot freeboard and 25 year, 24-hour runoff volume. The maximum drawdown level shall be the lagoon level that provides volume for the required minimum treatment volume plus the volume of accumulated sludge between sludge removal events. Permanent markers shall be installed at these elevations. The proper operating range of the lagoon is above the maximum drawdown level and below the maximum operating level. These markers shall be referenced and described in the O&M plan.

**Emptying facilities.** Facilities shall be provided for drawdown of the waste treatment lagoon. It may be a dock, a pumping platform, a retaining wall, or a ramp. Ramps for vehicle access into a lagoon shall have a slope of 10 horizontal to 1 vertical or flatter. Steeper slopes may be used if special traction surfaces are provided or if the ramp will only be used as an access point for pumping equipment.

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**Sludge removal.** Provision shall be made for periodic removal of accumulated sludge to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the size and shape of the lagoon and type of seal, if any.

**Erosion protection.** Embankments and areas disturbed by construction of the facility shall be treated to control erosion.

**Safety.** Design shall include appropriate safety features to minimize the hazards of the lagoon. The lagoon shall be fenced around the perimeter and warning signs posted to prevent children and others from using it for other than its intended purpose.

#### **Additional Criteria for Anaerobic Lagoons**

**Loading rate.** Anaerobic lagoons shall be designed to have a minimum treatment volume based on Volatile Solids (VS) loading per unit. Maximum loading rates are found in Chapter 10 of the Agricultural Waste Management Field Handbook (AWMFH).

**Depth requirements.** The minimum depth at maximum drawdown shall be 6 feet. The maximum depth of the lagoon is dictated by the site and equipment.

#### **Additional Criteria for Naturally Aerobic Lagoons**

**Loading rate.** Naturally aerobic lagoons shall be designed to have a minimum treatment surface area as determined on the basis of daily BOD<sub>5</sub> loading per unit of lagoon surface. The required minimum treatment surface area shall be the surface area at maximum drawdown. Allowable loading rates are found in Chapter 10 of the AWMFH.

**Depth requirements.** The minimum depth at maximum drawdown shall be 2 feet. The maximum liquid level shall be 5 feet.

#### **Additional Criteria for Mechanically Aerated Lagoons**

**Loading rate.** Mechanically aerated waste treatment lagoons' treatment function shall be designed on the basis of daily BOD<sub>5</sub> loading and

aeration equipment manufacturer's performance data for oxygen transfer and mixing. Aeration equipment shall provide a minimum of 1 pound of oxygen for each pound of daily BOD<sub>5</sub> loading. 4

### **CONSIDERATIONS**

#### **General**

Waste treatment lagoons should be located as close to the source of waste and polluted runoff as possible. In addition, they should be located considering prevailing winds and landscape elements such as building arrangement, landform, and vegetation to minimize odors and visual resource problems.

For lagoons requiring approval from IDEM, the minimum storage period shall be 180 days.

Solid/liquid separation treatment should be considered between the waste source and the lagoon to reduce loading.

Non-polluted runoff should be excluded to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

Due consideration should be given to economics, the overall waste management system plan, and safety and health factors.

The Indiana Department of Environmental Management (IDEM) defines a confined feeding operation as the confined feeding of a minimum number of animals (Table 3). Any operation that exceeds these numbers is required to obtain approval from IDEM.

**Table 3-Confined Feeding Operation  
Minimum Numbers**

Animal	Number
Cattle	300
Swine	600
Sheep	600
Fowl	30,000

In addition "other animal feeding operations" may also be required to obtain approval. "Other

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animal feeding operations” are defined as the confined feeding of : (1) at least 300 horses, (2) at least 5,000 ducks in a wet operation, or (3) at least 30,000 ducks in a dry operation. Combinations of species can also require approval based on the sum of the percentages of the actual numbers of each species divided by the minimum numbers.

All lagoons requiring IDEM approval must have a professional engineer’s certification of the plans and specifications.

### **Considerations for Minimizing the Impact of Odors**

For sites located where odors are a concern, the following should be considered:

- Reducing loading rates of anaerobic lagoons to at least one half the values given in Chapter 10 of the AWMFH.
- Covering the lagoon with a suitable cover.
- Using naturally aerated or mechanically aerated lagoons.
- Using composting in conjunction with a solid waste system rather than a liquid or slurry system.
- Using an anaerobic digester and biogas capture system.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for the waste treatment lagoon shall be in keeping with this standard and other applicable federal, state, and local codes. The plans must show all features required for the proper installation and functioning of the practice including, but not limited to: Plan view, structure cross-sections, pipe profiles, drainage details, erosion and sediment controls, access, safety features, and foundation requirements.

### **OPERATION AND MAINTENANCE**

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A written operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The plan shall contain the operational requirements for emptying the storage facility. This shall include the requirement that effluent from the lagoon shall be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan. The effluent should not be removed below the minimum treatment volume. The O&M plan shall detail any actions which the farmer must take to insure that this volume is maintained.

Further, the O&M plan shall detail how and when the sludge will be removed from the lagoon and where it will be disposed of. The sludge will have a higher nutrient content than the effluent removed from the lagoon on a regular basis. The sludge shall be tested for nutrient content before spreading.

In addition, the plan shall include the requirement that following storms, waste shall be removed at the earliest environmentally safe period to ensure that sufficient capacity is available to accommodate subsequent storms. The plan shall also detail emergency procedures that will be followed in case of an effluent spill or an accident causing personal injury and shall be posted on-site.

### **REFERENCES**

- Indiana Department Of Environmental (IDEM), Office of Land Quality, “Confined Feeding Control Law”
- Indiana Department of Natural Resources, Division of Water, “Construction in a Floodway Permit”
- USDA-NRCS, Agricultural Waste Management Field Handbook (AWMFH)
- USDA-NRCS, National Engineering Manual, Part 531, Geology

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